UNMET DEMAND FOR OUTDOOR RECREATION IN THE MOGOLLON RIM STUDY AREA (16-265-CA) AND EFFECTS OF SELECTED MANAGEMENT ALTERNATIVES ON RECREATIONAL USE IN THE MOGOLLON RIM AREA (16-307-CT)

Final Report

to

Rocky Mountain Forest and Range Experiment Station
U.S.D.A., Forest Service
Ft. Collins, Colorado

for

"Unmet Demand for Outdoor Recreation In
The Mogollon Rim Study Area"
(16-265-CA)

&

"Effects of Selected Management Alternatives
On Recreational Use In The Mogollon Rim Area"
(16-307-CT)

David A. King
Principal Investigator
&
Merton T. Richards
Research Associate
School of Renewable Natural Resources
The University of Arizona
Tucson, Arizona

November 10, 1975

Introduction

This is a final report for the two studies undertaken under agreements 16-265-CA and 16-307-CT. The studies are so interrelated that a single, final report covering both seemed appropriate.

Manuscripts for three proposed publications resulting from the two studies have been prepared. Two of these, "Recreational Visitors to the Mogollon Rim Area of Arizona" and "Six Recreation Demand Source Populations in Arizona" are in the review process for publication by the Arizona Agricultural Experiment Station and have been or are being reviewed by the Rocky Mountain Forest and Range Experiment Station. The third manuscript, "Recreational Consumption Functions for the Mogollon Rim Area of Arizona" is about to be submitted for review for publication as a Technical Bulletin of the Agricultural Experiment Station. A copy of it will be submitted to the Rocky Monntain Station for review as soon as it is revised in light of comments from colleagues in the School of Renewable Natural Resources.

This report is organized according to the objectives of the two studies as contained in the research agreements. Exposition of the methods used to obtain the results presented is minimized since the study plan and the manuscripts of the proposed publications contain detailed descriptions of the study methods and are available to Forest Service personnel.

The objectives of the two studies have been met with varying degrees of success. The second objective of both agreements, "estimate the influence on recreation use of management alternatives considered in the National Forest System, Region 3, Mogollon Rim study area", was not completely

accomplished because the management alternatives presented in the draft environmental statement for the study area, "Mogollon Rim Area Land Use Plan" (U.S.D.A., Forest Service 1973), were expressed at a very general level and were really objectives for management units. Instead, a method for using the results of the two studies to accomplish the second objective, given specific information on management alternatives, was developed for application in subsequent program planning.

A fairly large proportion of this report is devoted to a description and explanation of this method for utilizing the use projections. The reason for doing so is that, to my knowledge, the method is not being used in National Forest recreation planning and it may be a means of utilizing recreational use forecasts based on incompletely specified recreational consumption models. Further, the method is valid only under certain conditions and assumptions and these should be well understood by anyone attempting to use it.

Present and Future Recreational Use of the Area

The first objective of agreement 16-265-CA was to determine recent trends in the amounts and kinds of recreational use taking place in the Mogollon Rim study area. Present use (1972) of the area was estimated by first estimating the amount of time spent in various activities, per trip, by parties visiting the area. Except for camping, these estimates were made in terms of visitor-hours and converted to visitor-days. Camping time was estimated as the number of calendar days the party occupied a camp unit.[1/] Data for this first step were gathered by personal interviews of a sample of parties visiting the area during the summer season of 1972.

The second step in estimating present use was the estimation of the number of trips per household to the area, during which various activities were engaged in, for six demand source populations which make up the majority of the area's market population. The data for this step were gathered via a mail survey of independent samples of households within each of six demand source populations. The six demand source populations sampled are roughly defined by their names; Phoenix metropolitan area, Tucson metropolitan area, Prescott-Wickenberg area, Flagstaff area, Holbrook-Winslow area, and Miami-Superior-Globe area.

The third step, estimating the number of households in each source population in 1972 was done by applying the rates of increase shown by the population projections prepared for the Arizona State Comprehensive

---

[1/] The terms area, site, and unit, in this report, refer to the total area under study, a given public campground or recreation spot (developed or undeveloped), and family unit (developed or undeveloped), respectively.

Outdoor Recreation Plan to the U.S. Census 1970 estimates of the number of households in each demand source population (U.S. Bureau of the Census, 1972). The ASCORP population projections were made for each of the six planning districts in Arizona and the rate applied to a given source population was that of the planning district within which it is located.

For a given activity, the product of the estimates of time spent per trip, the number of trips per household, and the number of households yields an estimate of the total use of the area for that activity by a given demand source population. The sum of these estimates across source populations gives an estimate of the total use of the area for the given activity by the six populations.

Total use of the Mogollon Rim Area, in 1972, for various recreational activities is shown in Table 1. Only nine activities are shown because the number of sample parties participating in other activities was too low, less than 25, to permit reasonable estimates of participation time. In the Appendix (Table 13), estimates of 1972 trips per household are presented for all of the activities included in the survey.

The estimates of participation in camping are expressed in visitor-calendar day units[2/] rather than standard visitor-day units, and measure camp unit occupancy. During the time of camp unit occupancy, members of a party could have been, and most probably were, engaged in other activities. Thus, the camping estimates cannot be added to those for the other activities. Since any part of a calendar day was counted as a "day" of

---

[2]Visitor-calendar days are the product of the length of the camping trip in calendar days and the number of people in the party. Calendar days were used because they are a better expression of the utilization of camping capacity.

Table 1. RECREATIONAL USE OF THE MOGOLLON RIM AREA IN 1972 AND PROJECTED USE FOR 1980 BY SIX ARIZONA SOURCE POPULATIONS[a]

Activity	1972 (Visitor-days)	1980 (Visitor-days)	Change (Percent)
Camping	3,541,687[b]	4,888,076	38.0
Picnicking	442,108	602,894	36.4
Fishing	569,690	830,900	45.8
Hiking	202,619	275,547	36.0
Driving and Sightseeing	892,721	1,249,203	40.0
Nature Study	81,803	117,889	44.1
Gathering Forest Products	21,073	29,330	39.2
Photography	77,665	108,739	40.0
Boating	120,886	168,842	40.0
Subtotal (excluding camping)	2,408,563	3,383,344	40.4

a. The six populations are: Phoenix metropolitan area, Tucson metropolitan area, Prescott-Wickenberg area, Globe-Superior-Miami area, Holbrook-Winslow area, Flagstaff area.

b. Camping use was estimated in visitor-calendar days of unit occupancy. Any part of a calendar day was counted as a whole day.

camping, the visitor-days of camping in the three "night" categories[3] defined in the Recreation Information Management (RIM) system cannot be derived simply by dividing the estimate by 2. An approximation to visitor-days of occupancy, however, can be obtained. Camping trips to the area were most frequently weekend trips of 3 calendar days, with parties typically arriving late Friday and leaving Sunday afternoon or evening. Thus, by multiplying the camping estimate by .67 and dividing by 2, a rough approximation of visitor-days of camp occupancy can be made.

The subtotal, excluding camping, shows a total use in the eight activities of 2,408,563 visitor-days in 1972. This is far greater than the Forest Service estimates of use in these activities for all of the six range districts, portions of which are in the study area. For calendar year 1971, Forest Service estimates of use total 293,000 visitor-days.[4] There is probably some upward bias in the estimates based on this study, but not of a magnitude to explain such a large difference. The major source of the difference is simply that the Mogollon Rim Area has received far more use than has been estimated by Forest Service personnel.

Trends in use are indicated by the 1980 projections of use, also shown in Table 1. The projections were made using the consumption functions developed to meet the first objective of agreement 16-307-CT, discussed in a later section of this report. Statistically acceptable[5]

---

[3] These are: Camping, auto; camping, trailer; and camping, tent.

[4] This estimate was taken from Appendix B, Draft Environmental Statement, Mogollon Rim Area Land Use Plan, 1973. U.S.D.A. Forest Service. mimeo.

[5] In the stepwise regression analysis used to estimate the equations, an F value corresponding to a 10 percent level of significance was used to

time prediction equations could be estimated only for camping, picnicking, fishing, hiking, and nature study. Likewise, prediction equations could not be estimated for all activities for all source populations. Hence, the projections for boating and photography shown in Table 1 are based solely on projected population growth under the assumption of constant trips per household and activity times per trip.

The projected percentage increases in use over the 8 year period seem very reasonable, averaging 4.5 to 5.7 percent per year. Fishing and nature study are projected to grow the most rapidly and picnicking and hiking least rapidly.

The projections carry an implicit supply assumption that must be recognized: the per household supply of recreational opportunities facing the six source populations will remain constant, in quality as well as quantity, over the 8 year projection period. Thus, an increase in the total supply of recreational opportunities in the study area, of a quality equivalent to the 1972 quality, is an inherent assumption of the projection model. If the capacity of the area is not increased, then additional use could not occur without deterioration of the quality of the recreational experiences.

The latter statement is supported by the finding that excess demand for many activities in the area did exist in 1972. Excess demand was

---

5/ (Continued) determine the entrance and retention of predictor variables. Further criteria used to determine the acceptability of an equation were: 1) If two or more functional forms explained variation in the dependent variable equally or almost equally well, the simpler form was chosen; 2) The form of the equation coinciding most closely with economic theory and knowledge of recreational behavior was chosen; and 3) The F value of R^2 had to be 4 times as great as the table value of F corresponding to a 10 percent level of significance.

defined as demand for recreational participation, at then current user costs, that was unfulfilled due to a lack of facilities or access. To determine whether excess demand existed, the respondents to both surveys were asked which activities they would like to do more of and the most important constraint preventing them from doing more.

In Table 2, the percent of households in the six source populations wishing to do more of the activities and indicating facilities as the constraint are shown. The questions, as expressed, were not specific to the Mogollon Rim Area. The results, however, indicate excess demand for the aggregate recreational opportunity supply facing each source population and the Mogollon Rim Area provides a major component of that supply.

It is interesting to note that the two source populations for which forest camping is least accessible, Phoenix and Globe, have the greatest excess demand for camping. The Tucson population which faces the most limited supply of fishing opportunities has the highest excess demand for fishing.

Although not directly related to the objectives of these studies, it must be pointed out that the most frequently mentioned constraint on recreational participation was time. Variation in the patterns of leisure time available to households was not completely taken into account in the analysis leading to the prediction equations. In fact, such variations among households may not be great enough to develop predictive relationships between leisure time variables and recreational participation. The important point is that if drastic changes occur in leisure time patterns, recreational use will probably increase much more than is indicated by the projections. A drastic change would be one in which a large proportion of the labor force was switched to a four day work week.

Table 2. PERCENT OF HOUSEHOLDS IN SIX DEMAND SOURCE POPULATIONS EXPRESSING EXCESS DEMAND FOR RECREATIONAL ACTIVITIES

Activity	Demand Source Population					
	Phoenix (n=329)	Globe (n=314)	Flagstaff (n=364)	Holbrook (n=286)	Tucson (n=328)	Prescott (n=316)
Camping	11.0	13.4	8.2	9.1	7.9	8.6
Picnicking	8.2	7.6	5.5	7.0	8.5	5.1
Fishing	6.1	6.4	7.2	6.3	9.5	6.6
Driving & sightseeing	1.2	1.6	1.4	1.8	1.2	---
Swimming	7.0	7.0	9.1	8.1	4.9	4.8
Off-road vehicle	1.9	1.6	2.2	---	.9	1.6
Boating	3.3	3.1	2.5	3.8	4.3	2.2
Photography	---	.6	---	---	.9	---
Nature study	.9	.6	.8	---	1.2	---
Hiking	1.5	2.2	1.3	1.0	2.1	.6
Horseback riding	---	---	---	---	---	---
Talks & programs	---	---	.8	1.8	---	.6

The recreational parties sampled in the Mogollon Rim Area were also asked which activities they would like to do more of, but were then asked to rank their preferences for their six most preferred activities. Then, for the top three ranked activities they wished to do more of, they were asked what was the most important constraint. Again, those who were constrained by facilities were categorized as having excess demand for the activities. The excess demand results based on this series of questions are presented in Table 3. The constraint question was open-ended and a list of 24 constraints was developed from the responses (See Appendix, Table 14). Fifteen of these were subcategories of a facility category and are combined in Table 3.

Excess demand among parties visiting the area was greatest for fishing. An important note here is that the most frequently mentioned constraint on fishing was lack of fishing success. Thus, fishing capacity, in visitor-days, was not constraining, but the quality of the fishing opportunities was.

For the activities listed, it is safe to conclude that excess demand was equal to or greater than zero. This means that the recreational capacity of the study area was controlling the recreational use of the area: supply is limiting the use of the area, not demand.

Recreational Use Consumption Functions

The first objective under agreement 16-307-CT was to develop recreational consumption functions for various recreational activities in the Mogollon Rim Area. In accomplishing this objective, a model for estimating and predicting recreational use of a recreational area was developed.

Table 3. RECREATIONAL PARTIES EXPRESSING EXCESS DEMAND FOR VARIOUS RECREATIONAL ACTIVITIES EXPRESSED AS PERCENTAGE OF PARTIES VISITING THE MOGOLLON RIM AREA, 1972 n=473

Activity	Percent of Parties
Camping	7.2
Picnicking	.6
Fishing	20.7
Nature study	.8
Hiking	2.7
Driving and sightseeing	1.0
Boating	4.2
Swimming	5.3
ORV use	3.0
Horseback riding	.8
Attending talks and programs	1.3

The model combines characteristics of the population specific and the site (area) specific-user models described by Cicchetti, Fisher and Smith (1973). The model takes into account the fact that recreational consumption (participation) is the result of the supply of recreational opportunities and the demand for recreational experiences.

The model consists of two stages, the first for estimation of trips per household to the area from the market population and the second for estimation of the amount of time spent in individual activities per household trip. Data gathered via the mail survey of the independent samples of households in the six demand source populations were used to estimate the activity trip prediction equations of the first stage of the model. Separate equations were estimated for each demand source population. This approach was used to take into account variations in the supply of recreational opportunities facing different geographical segments of the market population. The data gathered in the survey of recreational parties in the study area were used to estimate the activity time equations of the second stage of the model.

A stepwise regression procedure that proceeded in a forward mode, but which provided for removal of variables entered on previous steps, was used to estimate both types of prediction equations. Because of the limitations of sample size, equations for all activities were not estimated. As noted previously, statistically acceptable prediction equations could not be estimated for some activities even though the number of observations was considered sufficient.

The activity trip prediction equations are presented in Tables 4-11. The activity time equations are presented in Table 12. The tables show

TABLE 4. ESTIMATED CAMPING TRIP FUNCTIONS FOR EACH DEMAND SOURCE POPULATION

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.2037	.1041	.1940	.1361	.1607	.1276
d.f.	6-322	4-308	6-357	6-279	6-316	3-304
F	13.7259	8.9492	14.3226	7.3242	10.0868	14.8159
$\bar{y}$	.7325	.5783	.1621	.9371	.1672	.2110
Constant	.6424	-.2457	.1152	.2602	.7629	.0463
LINCOME	-.2284 (2.61)					
PMRYRVIS	.0338 (2.43)	.0252 (3.07)		.0208 (2.08)	.0358 (3.44)	.0171 (3.98)
CAMPDOMO	.8744 (3.95)					
HHMEM16L	.1348 (1.75)					
FAMSIZE		.0884 (2.15)				
EDUCHHHD					-.1592 (1.92)	
EDUCHHD2					.0069 (2.38)	
YRHHDCMP					.0181 (4.11)	
SASCOR				.4496 (2.96)		.1169 (2.12)
PPSCOR			.1813 (5.24)			
LDSCOR			-.1095 (3.19)			

Table 4. (Continued)

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
SHLTYPPC	1.2147 (3.91)	.6042 (2.78)	.1932 (2.38)	.5633 (1.71)		
SHLTYPVN	1.3673 (2.32)			1.1466 (1.72)		
SHLTYPTN		.5076 (2.40)		.6284 (2.06)		.3891 (3.31)
SHLTYPCT			.2518 (2.83)		.6452 (2.89)	
SHLTYPTH				2.6419 (2.87)		
MOTYPG8P			-.2682 (2.60)			
MOTYPEL			1.3114 (5.78)			
NOBAKPAK					-.1378 (2.33)	

Table 5. ESTIMATED PICNIC TRIP FUNCTIONS FOR EACH DEMAND SOURCE POPULATION

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.1047	.1672	.1165	.0776	.1082	.0401
d.f.	4-315	3-310	9-334	2-283	5-317	2-307
F	9.2106	20.7496	4.8937	11.8972	7.6922	6.5607
$\bar{y}$	.7125	.4618	.2413	1.3531	.1300	.1774
Constant	.6650	-.2339	.2452	1.2350	.6315	.5001
LINCOME	-.2056 (2.11)					
LPMRYRVS	.9461 (4.40)					
PMRYRVIS		.0348 (5.80)	.0209 (4.54)	.0560 (4.38)		.0147 (3.00)
PCNCDOMO	.4604 (2.13)					
WKSPDVAC	.1085 (1.77)		.0398 (1.83)			
HHMEM16P					.1004 (1.66)	
FAMSIZE		.1221 (3.92)				
AGE			-.0368 (2.01)			-.0073 (2.03)
AGE2			.0003 (1.50)			
EDUCHHD			.1200 (1.96)		-.1771 (1.83)	
EDUCHHD2			-.0046 (2.09)		.0080 (2.35)	
HHDCMP			-.0137 (1.71)			

Table 5. (Continued)

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
YRHDCMP2			.0003 (1.50)		.0005 (5.00)	
PPSCOR		.2194 (2.22)				
NOBAKPAK			.0871 (2.44)		-.1398 (2.05)	

Table 6. ESTIMATED HIKE TRIP FUNCTIONS FOR EACH DEMAND SOURCE POPULATION

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.0354	.1394	.1303	.0181	.1220	.0317
d.f.	3-325	4-309	4-331	1-268	4-318	2-282
F	3.9737	12.5155	12.3932	4.9378	11.0510	4.6106
$\bar{y}$	.2827	.1943	.1726	.3630	.1146	.0667
Constant	.6675	-.4878	-.2035	.1198	.5950	.0457
LINCOME	-.1228 (1.90)					
PMRYRVIS		.0151 (2.96)	.0118 (2.74)	.0192 (2.23)		
HHMEM16L		.0618 (1.66)	-.0793 (2.26)			
HHMEM16P		.2083 (4.65)	.1100 (2.53)			.0705 (1.70)
EDUCHHHD						-.1576 (2.36)
EDUCHHD2						.0068 (2.96)
YRHHDCMP						.0705 (4.15)
PPSCOR		.1457 (1.76)				
LDSCOR	.2098 (2.22)					.0538 (1.99)
NOBAKPAK	.1242 (2.09)		.1654 (4.82)			.0539 (2.18)

Table 7. ESTIMATED FISHING TRIP FUNCTIONS FOR EACH DEMAND SOURCE POPULATION

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.0913	.0996	.1332	.1015	.0967	.1808
d.f.	4-316	3-308	4-331	2-228	6-316	7-271
F	7.9415	11.3599	12.7162	15.6958	5.6384	8.5414
$\bar{y}$	.4860	.5930	.1736	1.1604	.0836	.1824
Constant	.4433	.4060	-.0208	-.3397	.5722	.1029
PMRYRVIS	.0984 (3.49)	.0393 (3.48)		.0607 (4.46)	.0137 (2.04)	.0198 (4.50)
PMRYRVS2	-.0026 (2.89)					
HHMEM16P					.0575 (1.73)	
EDUCHHHD					-.1236 (2.32)	
EDUCHHD2					.0049 (2.72)	
AGEHHHD	-.0123 (2.02)					
WKSPDVAC		-.1533 (2.02)				
YRHHDCMP					.0060 (2.22)	
YRHDCMP2						-.0001 (1.67)
FISHDOMO			.3061 (3.70)			
FSHTCKCS	.5070 (2.72)			.9924 (2.42)		
FSHTCKFL			.1869 (2.33)			.1691 (1.72)

Table 7. (Continued)

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
MOTYPEL					.4798 (2.16)	-.5776 (1.87)
MOTYPB8L			.5582 (3.64)			-.4362 (2.31)
MOTYPG8P		1.2762 (3.50)	-.4179 (2.96)			
BOTYPCI						.7105 (3.45)
SASCOR						.2266 (4.02)

Table 8. ESTIMATED DRIVING AND SIGHTSEEING FUNCTIONS FOR EACH POPULATION DEMAND SOURCE

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.0939	.1959	.0704	.1128	.1158	.0683
d.f.	4-328	4-308	2-355	2-283	3-324	3-312
F	8.3928	18.7565	13.4611	17.9905	14.1459	7.6186
$\bar{y}$	.9027	.6805	.6452	1.7133	.2104	.3924
Constant	.5635	-.2750	.3142	.5138	-.0892	.2839
PMRYRVIS	.0450 (3.69)	.0344 (4.78)	.0370 (3.98)	.0802 (5.42)	.0402 (3.65)	.0214 (3.19)
FAMSIZE		.1519 (4.20)				
WKSPDVAC					.0660 (2.14)	
YRHDCMP2					.0004 (4.00)	
SASCOR						.1626 (1.89)
LDSCOR	.3534 (3.05)	.3215 (2.88)				.1932 (2.20)
ORV4WD	.7011 (2.24)	.7730 (3.55)	.6544 (3.13)			
ORVSNDBG	1.7763 (1.85)					
ORVCYCLE				1.6541 (2.48)		

Table 9. ESTIMATED NATURE STUDY TRIP FUNCTIONS FOR EACH POPULATION DEMAND SOURCE

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson
R^2	.2498	.3151	.0799	.0525	.0602
D.F.	2-316	5-306	4-359	2-228	3-324
F	52.6245	28.1525	7.7920	7.7004	6.9186
$\bar{y}$	.1411	.0897	.0934	.3025	.1250
Constant	-.0144	-.5569	.0292	.1454	-.3132
PMRYRVIS		.0085 (3.04)	.0079 (2.93)	.0123 (2.24)	.0376 (2.58)
HHMEM16L		.1203 (5.84)			
HHMEM16P		.1734 (7.05)			.1271 (1.77)
WKSPDVAC	.0484 (3.04)				
YRHDCMP2					.0003 (1.50)
NATRDOMO	1.0562 (9.67)	.3902 (2.79)	.2181 (2.85)		
SASCOR		-.1063 (2.48)			
PPSCOR			-.0690 (1.87)		
LDSCOR				.2517 (2.90)	
NOBAKPAK			.0642 (2.87)		

Table 10. ESTIMATED OFF-ROAD VEHICLE TRIP FUNCTIONS FOR EACH POPULATION DEMAND SOURCE

Variable or Statistic	Phoenix	Globe	Flagstaff	Holbrook	Tucson	Prescott
R^2	.0955	.2484	.0410	.0681	.1245	.0810
d.f.	2-326	5-293	1-362	3-282	3-319	3-306
F	17.2160	19.3615	15.4753	6.8670	15.1189	8.9956
$\bar{y}$	.3222	.3177	.2088	.4056	.0929	.0806
Constant	.1420	-.0865	.0281	-.1504	-.0564	-.0451
PMRYRVIS		.0138 (2.46)		.0287 (3.05)	.0313 (3.60)	.0101 (3.26)
ORVDOMO		.9528 (4.62)			.6081 (3.63)	.1914 (2.23)
LDSCOR		.2270 (2.59)				
ORV4WD	1.4265 (5.48)	.5525 (3.01)	.8327 (3.94)	.9172 (1.97)	.4998 (2.98)	
ORVSNBG		2.2134 (4.52)				
ORVCYCLE	.3959 (1.66)			1.1254 (2.65)		.2832 (2.63)

Table 11. ESTIMATED FOREST PRODUCT GATHERING TRIP FUNCTIONS FOR FOUR POPULATION DEMAND SOURCES

Variable or Statistic	Phoenix	Globe	Holbrook	Tucson
R^2	.2494	.0531	.0302	.0386
d.f.	3-325	2-293	3-266	1-326
F	35.9954	8.2150	2.9276	13.0954
$\bar{y}$	.0486	.0338	.4111	.0091
Constant	.0037	-.0034	-.1865	.0035
PMRYRVIS				.0036 (3.60)
LPMRYRVS	.0766 (1.99)			
HHMEM16L		.0296 (1.26)		
YRHHDCMP			.0795 (2.65)	
YRHDCMP2			-.0014 (14.0)	
SASCOR			-.2885 (1.66)	
PPSCOR		.0716 (3.06)		
ORVSNDBG	2.0128 (10.15)			
ORVCYCLE	-.1058 (1.79)			

Table 12. ESTIMATED ACTIVITY TIME EQUATIONS FOR PARTIES VISITING THE MOGOLLON RIM AREA, 1972

Variable or Statistic	Camping	Picnicking	Activity Fishing	Nature Study	Hiking
R^2	.1846	.2192	.1811	.5008	.2406
d.f.	4-262	5-69	1-118	7-42	4-52
F	14.2822	3.8751	4.0032	6.0194	4.1178
Constant	15.3896	24.2730	51.4618	19.4722	18.2382
FAMGRP	-9.4882 (5.26)				
EQINVINC	5.5201 (2.24)			8.7430 (2.74)	9.4601 (1.98)
TOTFM16L	3.0964 (5.28)				
TRPYRMRA	-.2403 (1.88)				
YRVISMRA		1.2351 (2.57)			
SCALE2		11.2828 (1.85)			
PNOAMIL		.8356 (1.71)			
FISH		-22.6373 (2.31)			
PNOAMIL2		-.0080 (2.29)			
PICNIC			-30.6385 (2.00)	-10.5928 (2.06)	-15.0589 (2.05)
SITENS3				6.9741 (2.02)	
SITENS4				6.4885 (2.84)	
SITENS5				-6.6461 (3.38)	

Table 12. (Continued)

Variable or Statistic	Camping	Picnicking	Activity Fishing	Nature Study	Hiking
HIKE				14.4874 (2.68)	
SITEHK4					5.0732 (1.83)
GFP					18.2190 (1.87)

the R^2 values, degrees of freedom, F values of the R^2 values, means of the dependent variables, and regression coefficients with their corresponding "t" values. The equations were used to make the projections shown in Table 1. Projections, or data from which to make projections, were not available for all predictor variables. The predictor variables for which projections were available or were made included the following:

mean of log of household income
mean number of household members less than 16 years of age
mean number of household members 16 years or older
mean age of head of household
mean education of head of household
mean trips per year to the Mogollon Rim Area
whether fishing was engaged in
whether picnicking was engaged in
whether hiking was engaged in

For the other predictor variables, 1972 mean values were used.

An understanding of the assumptions underlying the empirical model and, consequently, the projections, is important in interpreting the results. Since the trip prediction equations were estimated for each demand source population, so as to account for differences in supply among populations, no supply variables appear in the trip prediction equations. Thus, projections of number of trips based on the trip prediction equations carry the assumption that the quality and quantity of the supply of recreational opportunities per household will remain constant over the prediction period. Further, because population growth is a positive factor in the projections, the predicted trips could not be expected to occur unless the total supply of opportunities would increase.

For the activity time equations, supply variables were considered in the analysis leading to the estimation of the equations. These supply

variables, however, were found to be useful predictors only in the nature study and hiking equations. Since supply variables are not specified in the camping, picnicking, and fishing equations, their time predictions also carry the supply assumption identified above.

Another assumption is that the relationships between the predictor variables and recreational participation existing in 1972 will not change during the prediction period. Because the relationships were estimated from cross-sectional data, this assumption is especially important to recognize. For example, the prediction equations should not be used for long term projections (more than 10 years beyond the base year).

Estimating the Influence of Management Alternatives on Recreational Participation

To accomplish this objective two conditions had to exist. The first was that the management alternatives for the area be specified in terms of recreational opportunity supply variables or measures. The second condition was that the empirical consumption model adequately specify the influence of supply variables on recreational use of the study area. Neither condition fully existed, therefore, specific, quantified estimates of the effects on recreational participation of management alternatives for the area could not be made.

With respect to the first condition, the alternatives that were developed, at least as indicated in the draft environmental statement noted previously, were expressions of management objectives for the various management units within the area. As such they were not sufficiently detailed to make possible the estimation of their effects on the recreational capacity of the area. It is at the next level of planning,

program planning, that the consequences of program alternatives for recreational opportunities (capacity) will be spelled out. And it is through their effects on the supply of recreational opportunities, or recreational capacity, that the alternatives may affect recreational use of the area.

The second condition, that the effect of supply be adequately specified in the consumption model, was not met for the reasons already explained. In other words, the equations cannot be used to estimate the effects of supply changes simply because they contain no supply variables (with the exception of the nature study and hiking time equations). To reiterate, the projection model assumes a constant quality and quantity of recreational opportunity supply (capacity) per household over time. This supply assumption, however, does not make the projections useless but does require that a method for using the projections for estimating the participation effects of supply changes be developed. Such a method was developed.

The first requirement considered in developing the method was to account for the quality of the recreational opportunity supply of the area. If the quantity of capacity per capita remained constant (an assumption of the model) and increased use beyond that due to population growth was projected, the increased use could take place only at increased densities per unit of capacity. Thus, at least one dimension of quality, perhaps the most important, would have changed. This first requirement was accomplished by expressing the current capacity in visitor-days per physical unit of capacity, thereby expressing capacity at its current quality.

To obtain this expression empirically requires the measurement of capacity in both terms, visitor-days and physical units. The two should be related and the expression of one in terms of the other is a transformation linking supply and demand in the absence of a fully specified and identified consumption model. The transformation is an expression of the relationship between the two capacity measures and it should be such that it preserves the perception of the supply of recreational opportunities held by the individuals or households in the area's market population. For example, a transformation that might not preserve such perceptions is one based on an arbitrary standard such as one family camping unit per 100 visitor-days of camping. The preservation of perceptions is necessary because the preference factor in demand is, in part, based upon them.

Ideally, the transformation should be based on research into the nature of the perceptions people hold of recreational resources. Although such a research base has not been completed, a perception preserving transformation can be derived for areas and activities for which excess demand is equal to or greater than zero, the case for some activities in the Mogollon Rim Area. Given the stated condition of excess demand, present participation in an activity is an area's capacity to provide for the activity, expressed in visitor-days. This is so because, if excess demand is equal to or greater than zero, participation is governed by capacity (supply). Thus, the perception of the available capacity held by the present and potential recreational visitors is expressed by this participation measure of capacity.

The related physical measure of capacity is determined simply by identifying the sites at which participation is taking place and measuring

their capacity in physical units. The units of measure used depend on the nature of the activities and could be as simple as acres of throw-down camp and picnic sites or miles of accessible fishing stream. Such measures may seem extremely simplistic when considering the diverse nature of recreational experiences and the motivations of the participants. The diversities, however, are reflected in the participation measure of capacity, given the necessary condition of excess demand.

Once the measurement of the area's capacity in physical units has been made, the transformation for the activity is the ratio of visitor-days of participation to the physical capacity of the area for the activity. By measuring only those sites currently used for the activity, perceptions will be preserved in the transformation to the extent they are reflected in the demand for the activity. The market population's state of knowledge regarding available sites will also be preserved.

To predict the effect on capacity of a land management program alternative it will often be necessary to consider sites not currently used for a recreational activity, but suitable for one or more activities. If the visitor is viewed as a producer of satisfaction, the concern is with the suitability of the sites as inputs to a satisfaction producing process, not with their ability to withstand the impacts of recreational use. Therefore, to determine the capacity effects of making new sites available it is necessary to determine the characteristics of environments and facilities suitable to potential recreational visitors for various activities. It is at this point of defining suitability that perceptions enter and the research base for assuming preservation of perceptions in the transformation is not available. To the extent the

planner's perceptions differ from those of the potential visitors, perception preservation is lost. Reduction of these perceptual differences can be accomplished by using the characteristics of sites currently in use as guidelines for determining the suitability of potential sites.

The ratio of current participation to current physical capacity is referred to as the baseline ratio. The amount of probable participation in a given year is estimated by comparing the ratio of projected visitor-days of use to the physical capacity for the given year to the baseline ratio. If the new ratio is greater than the baseline ratio, the probable particpation will be at least equal to the projected participation, with greater than projected participation if excess demand is greater than zero. Moreover, a reduction of physical capacity would be expected to reduce participation by the amount of the reduction expressed in visitor-days.

To better explicate the approach, the following hypothetical case, using graphical analysis, is presented. Suppose a recreational area receives 10,000 visitor-days of stream fishing per year and excess demand for the activity is equal to or greater than zero. Identification and inventory of the locations at which this use occurs shows that it takes place on 100 miles of stream. The participation originates from a market population of 200,000 households. The baseline capacity ratio is 10,000/100 or 100 annual visitor-days of stream fishing per mile of accessible stream.

Now suppose that prediction equations indicate that visitor-days of fishing per household will increase from a current .05 to .06 in ten years. The size of the market population is projected to grow to 250,000 households

during this time. Thus, total fishing participation in the area is projected to increase to 15,000 visitor days, assuming that a constant quality and quantity of capacity per household is maintained. The total supply of accessible stream fishing would have to increase to 150 miles to accommodate this use at the same level of use density as in the base year. If no additional stream fishing capacity were provided and stream fishermen refused to accept more crowded conditions than presently exist, stream fishing use would remain constant. It might be argued that increased use would occur because fishermen would accept increased crowding. Excess demand being equal to or greater than zero, however, indicates an unwillingness to accept more crowding than presently exists.

Figure 1 illustrates the approach and provides for graphical analysis of the effects of capacity changing alternatives with respect to use projections. Two vertical axes are used in the figure to show the two measures of capacity, total accessible miles of fishing streams and thousands of visitor-days of fishing. The vertical relationship of the two scales is determined by the baseline ratio and shows, graphically, the specific, numerical value of the ratio. The solid horizontal line shows projected use if the total miles of fishing streams do not change over time. The sloping, dotted line shows projected use for each year given increases in total fishing capacity such that the projected use can be accomodated. The line is located simply by connecting the point of present use to the 10 year point of projected use. In general, the figure shows that use is controlled by capacity for capacities between the horizontal axis and the sloping, dotted line showing potential use.

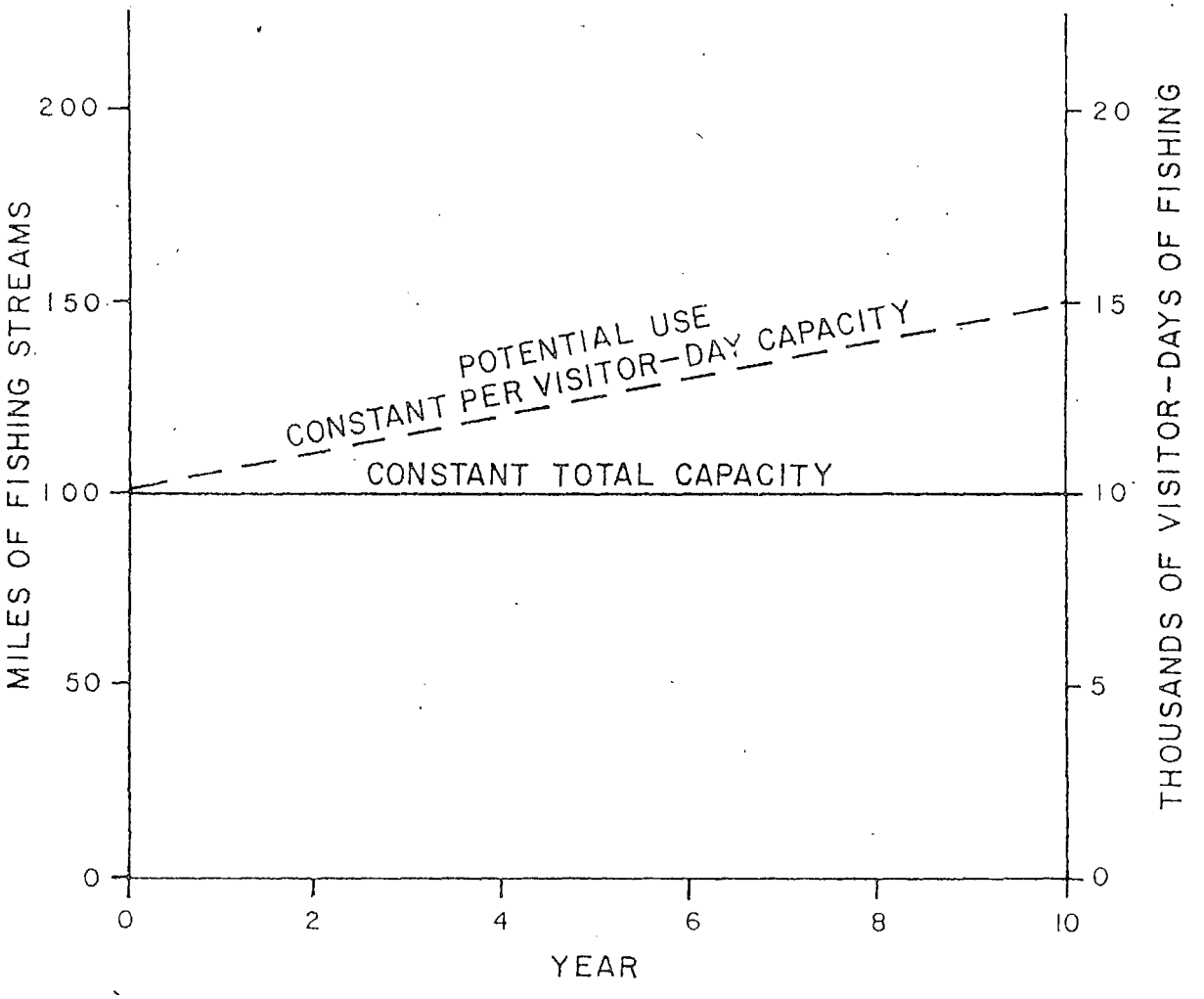

Figure 1. Graphical method of using projections when excess demand exists.

Consider the following example. If actions were taken to increase the mileage of accessible streams to 105 miles in year two, the probable use would be 10,500 visitor-days. The level of use projected by the equations, 11,000 visitor-days, would not occur because the capacity assumptions embodied in the equations would not have been fulfilled. In terms of the ratios, the baseline ratio was 100 and the new ratio is 11,000/105 or 104.8. The new ratio is greater than the baseline ratio indicating that probable use will be that provided by the capacity, the product of the baseline ratio and total capacity in year two, (100)(105) = 10,500.

Consider another example in which total stream mileage available for fishing decreases to 80 in year two. The probable result would be a decrease in participation to 8,000 visitor-days. The new ratio is 11,000/80 or 137.50 indicating probable use will be that provided for by the capacity, (100)(80) = 8,000 visitor-days.

Taking still another example, if actions were taken so the mileage of accessible stream increased to 150 miles in year two, the probable use would be at least 11,000 visitor-days. Whether it would be more than 11,000 would depend on whether excess demand is greater than zero. Since the amount of excess demand is not known, all that can be said is that at least the amount of use shown by the dotted line will probably occur for total capacities lying above it in any given year. Again in terms of the ratios, the new ratio is 11,000/150 or 70.3, less than the baseline ratio of 100, indicating probable use at least equal to the use projected.

Obviously, there would be situations where the total capacity of an area for an activity could not be increased simply because the natural environments are not available. For example, if it would be impossible to increase the mileage of accessible stream beyond 125 miles simply because of a lack of streams, projected use would go no higher than 12,500 visitor-days and excess demand would increase with time beyond the fifth year.

The graph also can be used to estimate the opportunity costs in visitor-days of not providing additional capacity or of reducing capacity. For example, if the natural environments in an area were available to increase capacity so as to provide for the use projected by the equations, but the additional capacity was not developed because of a lack of financial resources or the implementation of other land uses (including other recreational land uses), then the area between the horizontal line and the dotted line is an estimate of the opportunity costs of this inaction or action over the ten year period. For the hypothetical case, the opportunity cost of not providing capacity sufficient to accomodate projected use would be 25,000 visitor-days for the ten year period. Given economic values for stream fishing and using an appropriate discount rate, the present value of the flow of opportunity costs could be calculated.

The hypothetical case and the examples derived from it are illustrative only of the method and not intended to show a complete analysis. In actual practice, the effect of increasing the capacity of an area for one recreational activity on the capacity of the area for all other recreational activities would have to be included in an analysis of program

alternatives. Then, the resulting differential participation effects among activities would have to be weighted or valued to identify the most desirable alternative.

The important caveats of the approach bear repeating. First, excess demand must be equal to or greater than zero. Second, defining the characteristics that make sites suitable for various activities requires some judgement. This part of the approach is crude in that it does not specifically take into account variation in attractiveness among sites suitable for a given activity. Such variations tend, however, to be "averaged in" by defining suitability through examination of currently used sites.

Because it may be more easily dismissed, a third caveat deserves special emphasis. The approach depends on reliable estimates of current participation in various activities at various sites. Such estimates do not now exist for many National Forest developed sites, much less for dispersed sites. Least cost sampling methods to obtain reliable estimates of recreational use have been developed by the research branch of the Forest Service. The tools are available, they need only be put to use.

It is important also to recognize that saying an area is used to capacity, because of the existence of excess demand, does not necessarily mean that the design capacity of the area is totally used. Two related reasons account for this. First, the baseline capacity used in the approach is based on people's perceptions of design capacity and the amount of use the area is receiving. Hence, the baseline capacity is a perceived capacity as opposed to a design capacity. Second, these

perceptions are partially based on the degree of knowledge held by visitors and potential visitors about the area. In other words, the approach takes the state of people's perceptions about, and knowledge of, the area in the baseline year as given.

One of the findings of the on-site survey was that visitors' knowledge about the area is incomplete. Many visitors were unaware of some of the recreational opportunities available in the area. Hence, the perceived capacity of the area could be increased simply by providing additional information regarding availability of sites and activity opportunities. This aspect of the perceived capacity of an area is not explicitly handled in the suggested approach for use of the projections. All that can be said is that excess demand for the Mogollon Rim Area could be reduced through the provision of additional information to visitors and potential visitors.

Literature Cited

Cicchetti, Charles J., A.C. Fisher, and V.K. Smith. 1973. "Economic Models and Planning Outdoor Recreation". Operations Research 21(5):1104-1113.

U.S. Bureau of the Census. 1971. Census of Population:1970. General social and economic characteristics. Final report PC(1)-C4 Arizona. G.P.O. Washington, D.C.

U.S.D.A. Forest Service. 1967. Recreation Information Management Handbook.

U.S.D.A. Forest Service. 1973. Mogollon Rim Area Land Use Plan. Draft Environmental Statement. 69 pp.

APPENDIX

Variable Names and Definitions

Activity Trip Variables		Definitions
LINCOME	-	log of total family income before taxes
PMRYRVIS	-	previous years visited Mogollon Rim Area
CAMPDOMO	-	desire to do more camping, yes = 1, no = 0
HHMEM16L	-	number of household members less than 16 years of age
HHMEM16P	-	number of household members 16 years of age and older
FAMSIZE	-	size of family
EDUCHHD	-	years of education of household head
EDUCHHD2	-	square of years of education of household head
SHLTYPPC	-	ownership of pick-up camper, yes = 1, no = 0
SHLTYPVN	-	ownership of van, yes = 1, no = 0
SHLTYPTN	-	ownership of tent, yes = 1, no = 0
SHLTYPTH	-	ownership of travel home, yes = 1, no = 0
SHLTYPCT	-	ownership of camp trailer, yes = 1, no = 0
MOTYPG8L	-	ownership of gasoline motor less than 8 horsepower, yes = 1, no = 0
MOTYPG8P	-	ownership of gasoline motor 8 horsepower or larger, yes = 1, no = 0
MOTYPEL	-	ownership of electric motor, yes = 1, no = 0
NOBAKPAK	-	number of backpacks owned by household
LPMDYRVS	-	log of previous years visited Mogollon Rim Area
PCNCDOMO	-	desire to do more picnicking, yes = 1, no = 0
WKSPDVAC	-	weeks of paid vacation received by household head
AGE	-	age of head of household
AGE2	-	square of age of head of household
YRHHDCMP	-	number of years household head has camped
YRHDCMP2	-	square of YRHHDCMP
FISHDOMO	-	desire to do more fishing, yes = 1, no = 0
FSHTCKFL	-	ownership of fly rod & reel, yes = 1, no = 0
BOTYPCI	-	ownership of cartop or inflatable boat, yes = 1, no = 0
ORV4WD	-	ownership of four wheel drive vehicle, yes = 1, no = 0
ORVSNDBG	-	ownership of sandbuggy, yes = 1, no = 0
ORVCYCLE	-	ownership of off-road motorcycle, yes = 1, no = 0
NATRDOMO	-	desire to do more nature study, yes = 1, no = 0
ORVDOMO	-	desire to do more off-road vehicle travel, yes = 1, no = 0
LDSCOR	-	a preference factor variable; high values indicate preferences for:
		Flagstaff: driving and sightseeing
		relaxing
		picnicking
		off-road vehicle travel

Phoenix: driving and sightseeing
day hiking
nature study
photography
attending talks and programs
relaxing
picnicking

Prescott: driving and sightseeing
picnicking
photography
nature study
relaxing
day hiking
off-road vehicle travel

Globe: driving and sightseeing

Holbrook: nature study

PPSCOR - a preference factor variable; high values indicate preferences for:

Flagstaff: hiking
snow skiing
swimming
snow play
bicycling
camping
horseback riding

Globe: boating
waterskiing
swimming
bicycling
snow play
horseback riding

SASCOR - a preference factor variable; high values indicate preferences for:

Holbrook: hunting
fishing
camping

Prescott: boating
fishing

Globe: fishing
hunting
camping
boating

Globe: (cont.)
- off-road vehicle travel
- snow play

Activity Time Variables		Definitions
FAMGRP	-	party made up of nuclear family, yes = 1, no = 0
EQINVINC	-	ratio of dollar investment in equipment to total family income
TOTFM16L	-	total family members less than 16 years of age
TRPYRMRA	-	trips per year to the Mogollon Rim Area
YRVISMRA	-	years household head had visited Mogollon Rim Area
SCALE2	-	a preference factor, high values indicate preferences for picnicking
PNOAMIL	-	miles from place of overnight accomodation to picnic site
PICNIC	-	some or all members of party picnicked while on visit to Mogollon Rim Area, yes = 1, no = 0
HIKE	-	some or all members of party hiked while on visit to Mogollon Rim Area, yes = 1, no = 0
SITENS3	-	site factor variable, high values for sites providing access to trail system
SITENS4	-	site factor variable, high values for sites moderately developed and accessible
SITENS5	-	site factor variable, high values for sites located in poletimber stands
SITEHK4	-	score on site characteristic factor, high values associated with sites with low development
GFP	-	some or all members of party gathered forest products while on visit to Mogollon Rim Area, yes = 1, no = 0

Table 13. TRIPS PER HOUSEHOLD TO MOGOLLON RIM AREA BY ACTIVITIES ENGAGED IN, 1973

Activity	Population					
	Phoenix (n=329)	Globe (n=314)	Flagstaff (n=364)	Holbrook (n=286)	Tucson (n=328)	Prescott (n=316)
Camping	.7325	.5764	.1620	.9370	.1646	.2120
Picnicking	.6930	.4617	.2445	1.3531	.1280	.1803
Fishing	.4832	.5923	.1620	1.1468	.0823	.1740
Driving & Sightseeing	.9027	.6783	.6401	1.7132	.2103	.3924
Nature Study	.1367	.0891	.0934	.2972	.1250	.0474
Horseback Riding	.0547	.1146	.0027	.1153	.0182	.0189
Hiking	.2826	.1942	.1620	.3426	.1128	.0664
Swimming	.0729	.1305	.0384	.0979	.0304	.0316
Canoeing	.0030	.0063	.0082	.0314	---	---
Sailing	---	.0031	---	---	---	---
Boating	.0820	.1464	.0137	.1293	.0213	.0474
Off-Road Vehicle Use	.3221	.3084	.2087	.4055	.0914	.0854
Bicycling	.0334	.0700	---	.0349	.0030	.0031
Gathering Forest Products	.0486	.0318	.0741	.3881	.0091	.0031
Attending Talks & Programs	.0668	.0063	.0164	.0174	---	.0189
Photography	.3252	.2261	.1895	.4895	.0792	.1677

Table 14. ACTIVITY PARTICIPATION CONSTRAINTS

*Crowding

*Overdeveloped campgrounds

*Campsite too far from lake or stream

*Lack of talks & programs

Lack of hunting success

*Fish and Game Department draw system & restrictions on fishing

*Boating restrictions

*Lack of swimming sites

*Poor boat launching facilities

*Lack of water in streams

*Poor road conditions

*Too many roads

*Lack of ORV courses

*Lack of trails

Lack of equipment

Other family obligation

*Lack of information

Weather

Cost

Time

Health

Auxiliary commercial facilities

Other

*Considered as "facility" constraints